When I last wrote I had satisfied myself that he had learnt to regard the bringing of a card as a request, and that he could distinguish a card with the word "food" on it from a plain one, while I believed that he could distinguish between a card with "food" on it, and one with "out" on it. I have no doubt that he can distinguish between different words. For instance, when he is hungry he will bring a "food" card time after time until he has had enough, and then he lies down quietly for a nap. Again, when I am going for a walk and invite him to come, he gladly responds by picking up the "out" card and running triumphantly with it before me to the front door. In the same way he knows the "bone" card quite well. As regards water (which I spell phonetically so as not to confuse him unnecessarily), I keep a card always on the floor in my dressing-room, and whenever he is thirsty he goes off there, without any suggestion from me, and brings the card with perfect gravity. At the same time he is fond of a game, and if he is playful or excited will occasionally run about with any card. If through inadvertence he brings a card for something he does not want, when the corresponding object is shown him he seizes the card, takes it back again, and fetches the right one.

No one who has seen him look along a row of cards and select the right one can, I think, doubt that in bringing a card he feels that he is making a request, and that he can not only perfectly distinguish between one word and another, but also associate the word and the object.

I do not for a moment say that "Van" thus shows more intelligence than has been recorded in the case of other dogs; that is not my point, but it does seem to me that this method of instruction opens out a means by which dogs and other animals may be enabled to communicate with us more satisfactorily than hitherto.

I am still continuing my observations, and am now considering the best mode of testing him in very simple arithmetic, but I wish I could induce others to cooperate, for I feel satisfied that the system would well repay more time and attention than I am myself able to give. JOHN LUBBOCK

High Elms, Down, Kent

### "The Unity of Nature"

I REGRET that the Duke of Argyll should have been led by anything that I have written to make some of the remarks which appear in this week's issue of NATURE (p. 524). If a reviewer in a signed review cannot express freely his opinion upon a book without its being suggested that he is actuated by secondary and sinister motives, I fancy that few men of common honesty would care to continue the work of reviewing. Moreover, in the present instance the imputation of animus seems to me specially unjustifiable. I had almost forgotten the correspondence in NATURE to which the Duke alludes, but on now referring to it again I can only see that, if it was provocative of animus, there was assuredly no reason for the animus to have arisen on my side (see NATURE, vol. xxiv. pp. 581 and 604; vol. xxv. pp. 6 and 29). But, to ignore so unworthy a charge, and one which I can only suppose to have been made under a sense of irritation, I must explain that the Duke is under a wrong impression when he assumes that my objection to his advocacy of Theistic belief is due to what he regards as my aversion to Theism. As I have never been in the habit of "using your columns for the purpose of inculcating personal beliefs and disbeliefs on subjects which lie outside the boundaries of physical science," I shall not do so now. But in view of the slender grounds on which the Duke has felt himself entitled to infer that I "hold that the highest aim of the human intellect is to prove the mindlessness of nature," I feel it is desirable to correct the inference. For this purpose it is not needful that I should publish my "personal beliefs and disbeliefs." It is only needful to say that my previous remarks will be found to have been directed, not against the cause of Theism, but against its champion in the Duke of Argyll. Had my sympathies been more on the side of the materialists than they happen to be, the Duke of Argyll might not have found so much reason to quarrel with my "dislike" of his advocacy.

I may now turn to the Duke's remarks on those of my criticisms which he deems legitimate. Taking first the case of rudimentary organs, I quite agree with the statement that the question whether any particular structure now dissociated from use is to be regarded as "on the stocks or on the wane" is "a question of evidence from associated facts." Therefore it was that I said in my review that no illustration could be more unfortunate than the one which was chosen by the Duke as an example of rudimentary structures possibly on the stocks. For if the rudimentary organs which occur in the Cetacea admit of being supposed of doubtful interpretation in this matter, it is clear that in no case could the "evidence from associated facts" of structure and affinity be of any value. But in reality this evidence is nearly always so cogent that the difficulty suggested by the Duke is of a purely imaginary kind: evolutionists have no need ever to be puzzled in deciding whether a given structure is on the stocks or on the wane. Thus, for instance, let us take the cases which are adduced by the Duke himself. No evolutionist could be insane enough to imagine that the papillæ on the roof of the mouth of the giraffe are the remnants of whalebone, seeing that the whole structure and all the affinities of the animal are opposed to the inference that its ancestors were aquatic mammalia. Or, if we take the case of webbed feet, even if the dipper had begun to develop them, no evolutionist in his senses would infer that these incipient structures were remnants of structures once more fully developed, seeing that all the other structures and affinities of the bird prove that it belongs to a non-aquatic family. Cases of this kind actually occur in such birds as the grebe and the coot, where even apart from structure and affinity it is easy to see that the little piece of web must be regarded as a growing and not a dwindling organ, seeing that the birds are so strongly aquatic in their habits.

Considering next the Duke's remarks on instinct, I did not attempt to deal with the argument to which he refers, because I could not perceive that there was any argument to be dealt with. His view is a mere assumption to the effect that instincts are divinely implanted intuitions independent of experience; and to deny that experience, *in successive generations*, is the source of instinct is not to meet, by way of argument, the enormous mass of evidence which goes to prove that such is the case. Even within the limits of my review I should have thought there was evidence enough to have disposed of this denial.

As for the special case of the dipper, I only mentioned it in my review because the Duke lays great stress upon it in his book. No doubt better cases occur of newly-acquired instincts not yet associated with correlated structures, and in all such cases (whether good, bad, or indifferent), it is not a *non sequitur* mode of argument to say that, on the theory of the transmutation of instincts, the appropriate organs have not been developed, because, looking to the affinities of the animal, we are entitled to infer that time enough has not yet been allowed for their development. Again, I deny that it is for me, or for any other evolutionist, to prove that the ancestors of the dipper did not present those lesser modifications of structure which, according to the Duke, are now correlated with the aquatic instincts.[1] By "proof" he no doubt means the display of the ancestral form, and not the study of allied species. Proof of this kind is not attainable, but neither is it required. The question whether instincts are fixed intuitions or admit of being modified by accumulative experience with natural selection—*i.e.* whether they are or are not subject to evolution—is a question that does not require to be settled on the narrow basis of any one particular case. And if we take a broad view of all the instincts known to us, the combined weight of their testimony to the fact of transmutation is simply overwhelming.

London, April 4 GEORGE J. ROMANES

### The Remarkable Sunsets

THE remarkable *red sunsets* and after-glows, about which so much has been written of late, still continue here, but in a less intense form. A remarkable one occurred last night, and while watching it I determined to send you a brief account of my experiences in the matter. It is of little use going into descriptions of the appearances which are now well known, but the one which occurred last evening was unusually fine. It was a stormy wild evening, with black clouds all around, except in the west, where, from about 10° above the horizon to near the zenith, it was quite clear, and of a pale orange glow. A quarter of an hour after sunset three immense rays through rifts in the cloud bank sprang up almost suddenly, and took quite an intense crimson lake colour, which lasted about ten minutes.

Our brightest displays occurred in October and November last, and frequently bathed the whole landscape in a deep

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[1] I say "according to the Duke," because, according to Mr. Darwin, "in the case of the water-ouzel the acutest observer, by examining its dead body, would never have suspected its sub-aquatic habits" ("Origin of Species," 6th ed., p. 142).

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crimson glow. These skies were often still more gorgeous in the morning, and on some occasions were so wonderful as to be styled *frightful* by some observers. I witnessed one of these sunrises from an altitude of 3000 feet in January, and it was almost an *awful* sight. The view to the east was over about thirty miles of plains to distant mountains; a low mist hung over the low ground, and the surface appeared slightly rolling as seen from above. The sky half an hour before sunrise was so intensely red, almost to the zenith, that it gave this mist the appearance of a sea of blood. Every object, tree-trunks, fern-trees, bushes, rocks, and the cottages about the hills, was of a similar lurid colour; still there was not yet sufficient light to read by comfortably. This display reminded me of the wonderfully red aurora witnessed in Australia on April 5, 1870, when the red light was so intense that ordinary newspaper type could be read by it at ten o'clock on a moonless night, the type appearing as if set in a blood-red sheet. This was the first time I recorded the *red spectrum line* of the aurora, and I think was one of the earliest observations of this fact.

Some of the recent sunsets have looked very much like an aurora in the west, and faint traces of stratification lent additional similarity; indeed on one night early in December, the *after-glow* merged into a beautiful aurora, and silver streamers were seen before all the red glow had disappeared.

From all over Australia reports of wonderful sunsets and sunrises have been sent to me. In one case the *red glow* was reported as margined by an immense *black bow* stretching across from north-west to south-west. On several occasions these glows prolonged the twilight considerably, and a correspondent at Urana, in New South Wales, described one occasion where approaching darkness after one of these sunsets at length compelled him to leave off watering his garden, but suddenly the light increased again sufficiently to induce him to resume his work; and he states that a similar accession of light—each time fainter—occurred on that same evening.

The season over the south of Australia especially, but all over the continent, has been remarkable, and, so far as this colony is concerned, unprecedented in my thirty-three years' knowledge of the climate. January, February, and March are usually our dry, hot months; this year they have been wet and cold ones. The average rainfall for January has been 1·60 inches; this year it was 4·75 inches. For February the average is 1·95 inches, and up to this date (the 27th) it has been also 1·95 inches. The mean temperature for January was 3°·5 below the average, and for February 2° below. Stormy, squally, wintry weather has predominated, with now and then a very hot or a tropical day for a change.

Even before the Krakatoa outburst the northern parts of Tasmania had become subject to prolonged *earth tremors*, with now and then a decided earthquake shock. These disturbances still continue, and appear to be extending northwards, for on the 15th of this month a shock was felt at Gabo Island, at the south-east extremity of Australia, and a very severe one again on the 17th, when a curious and sudden barometric disturbance, not unlike that at the time of the Java catastrophe, was shown on our barographs.

While on this subject it may be as well to state that Mr. Barrachi, one of my assistants, while at Port Darwin determining the difference of longitude between that place and Singapore in March 1883, saw sunsets, followed by after-glows, which prolonged the usual short twilights to a very considerable extent, and he states they were equally remarkable with those witnessed here. They only occurred either just before or just after very heavy rains.

Referring to the various hypotheses which have found their way into print explanatory of the unusual phenomena attending sunrise and sunset since August 1883, the belief that they have been in some way brought about by the Krakatoa eruption appears to be generally accepted, and while some doubt may be thrown on this assumption by records of equally remarkable chromatic effects at both sunrise and sunset and about the sun at other times of the day prior to the eruption, it must be admitted at present that the volcanic eruption has strong claims to credence.

There can be no doubt that, whatever the prime cause, the effects are due to the presence in the higher regions of our atmosphere of a *form of matter* not usually there, at least to such an extent. Now this matter, or *form of matter*, may, as far as we know, be due to Krakatoa, to the earth's orbit traversing streams or regions pervaded with extremely fine meteoric dust, or to any other cause that might either introduce new or alter the form of existing matter.

It is well known in the laboratory that certain chemical combinations and mechanical mixtures will exist as such, but in a most unstable form,—a concussion or sharp sound, an electric spark, &c., either breaks them up or brings about a change of form so as to present altogether different physical properties. Now it is also well known that at the time of the Krakatoa eruption barometric pressure was spasmodically affected all over the world. Everywhere where barographs have been recorded this fact appears. This atmospheric shudder, undoubtedly originating at Krakatoa, was, I have reason to believe, conveyed rapidly from the centre through the higher and more tenuous regions of atmosphere, but affected the lower strata in its passage. This would perhaps account for the immense distance—thousands of miles—over which, it has been widely reported, explosions were heard about the time of the occurrence of the outburst.

Now if we assume that on the peripheral regions of our atmosphere *gases* and *forms of matter* exist in not very stable combinations or mixtures, it requires no great stretch of our imagination to picture the result of this great atmospheric shudder bringing about an alteration in the form or proportion of matter, and consequently such a change in its optical properties as to produce the unusual and remarkable effects which have been so universal. ROBT. J. ELLERY

Melbourne Observatory, February 27

UNDER date of January 14 I named the bark *C. Southard Hurlburt* as having observed the glow on September 3. She was dismasted in a cyclone August 8, and came to Honolulu for repairs. On the former date she was in about lat. 17° N., long. 125° W. The captain's wife, Mrs. Davis, described the phenomena to me as extremely brilliant.

Only last week I learned from Hon. H. M. Whitney, Postmaster-General, that on September 5 Mrs. Whitney and himself distinctly observed the sun's disk before setting to be *green*. His residence was an exception to most of ours in Honolulu, from which trees cut off a view of the horizon. My wife spoke much that night of a strange green cumulus, seen by her ten minutes before calling me to observe the portentous masses of colour pouring out all over the sky.

I beg special attention to my former remark of the "earth-shadow sharply cutting off" the upper rim of the first glow. This was very manifest in the strong heavy glows of September, showing clearly that the first glow directly reflected the sun's rays, while in the after-glow which had no defined upper rim, but continued much longer, the haze reflects only the light of the first glow. This bears on estimates of the height of the haze.

Observers here are well agreed that during November there was a very great abatement of the glows, amounting almost to a cessation, although the whitish corona was always well developed through the day. Early in December the glows were renewed, and for six weeks continued quite as brilliant as during October. They are now somewhat abated, although quite uniform nightly. In September and October they were extremely unequal, as well as varying in position of greater colour, south or north of west.

As this revival of our glows closely followed their general diffusion over Europe and the United States, I suggest that this was the arrival in force by slow marches of the main body constituting the great *cone* of vapours, which, falling into the atmosphere in September, covered like a pall the Indian Ocean and Peninsula, down the extended western slope of which cone the light upper vapours were sent by the westward thrust of the earth's rotation, to find speed in their downward slide to carry them at once around the tropical belt as a light advance guard (as set forth in my letter of January 14). As the September haze became gradually dissipated, so the later December arrivals are wasting away. S. E. BISHOP

Honolulu, January 30

AT Fanning's Island, long. 159° 22′ W., lat. 3° 52′ N., on September 4 last, the proprietor, Mr. Greig, states that the sun and sky had an extraordinary appearance; the sun "looked like a copper kettle." Lurid colours covered the sky. Great fears were felt for the safety of his schooner, the *Jennie Walker*, which sailed three days before.

From the master of the *Jennie Walker* I learn that on Sep-

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